

**FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE  
NUMBER: 02-1E-069 -X**

**SUBSYSTEM NAME: LANDING DECELERATION - WHEEL, BRAKE & TIRE  
REVISION: 3 08/03/97**

**PART DATA**

<b>PART NAME</b>	<b>PART NUMBER</b>
<b>VENDOR NAME</b>	<b>VENDOR NUMBER</b>
LRU : MLG WHEEL ASSEMBLY	MC621-0051

**EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:  
MAIN LANDING GEAR WHEEL TIRE PRESSURE DECAY MONITOR NG SYSTEM (TPDMS)  
PLUG**

**REFERENCE DESIGNATORS:**

**QUANTITY OF LIKE ITEMS: 4  
ONE PER WHEEL**

**FUNCTION:**

**DUAL PRESSURE SENSOR USED TO MONITOR MAIN LANDING GEAR TIRE PRESSURE  
DECAY RATES ON THE PAD AND ORBIT (REPLACES THE OVERINFLATION PLUG).**

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**SUBSYSTEM NAME: LANDING DECELERATION - WHEEL, BRAKE & TIRE**

**LRU: MLG WHEEL ASSEMBLY**

**CRITICALITY OF THIS**

**ITEM NAME: MLG WHEEL ASSEMBLY**

**FAILURE MODE: 1/1**

**FAILURE MODE:**

**RUPTURED TIRE PRESSURE DECAY MONITORING SYSTEM (TPDMS)**

**MISSION PHASE: DO DE-ORBIT**

<b>VEHICLE/PAYLOAD/KIT EFFECTIVITY:</b>	102	COLUMBIA
	103	DISCOVERY
	104	ATLANTIS
	105	ENDEAVOUR

**CAUSE:**

**DEFECTIVE MATERIAL, CORROSION**

**CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO**

<b>REDUNDANCY SCREEN</b>	A) N/A
	B) N/A
	C) N/A

**PASS/FAIL RATIONALE:**

A)

B)

C)

**- FAILURE EFFECTS -**

**(A) SUBSYSTEM:**

**LOSS OF ROLLING AND LOAD CARRYING CAPABILITY ON AFFECTED TIRE/WHEEL ASSEMBLY. LOSS OF ADJACENT TIRE/WHEEL ASSEMBLY AND LOSS OF ALL BRAKING CAPABILITY ON AFFECTED STRUT. PROBABLE FAILURE OF AFFECTED MLG STRUT OR ITS ATTACHMENTS.**

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**(B) INTERFACING SUBSYSTEM(S):**  
SAME AS A.

**(C) MISSION:**  
PROBABLE LOSS OF MISSION/CREW/VEHICLE DUE TO THE EXCESSIVE YAWING FORCES PRODUCED AND/OR LOSS OF 50 PERCENT OF BRAKING CAPABILITY CAUSING VEHICLE TO DEPART RUNWAY.

**(D) CREW, VEHICLE, AND ELEMENT(S):**  
SAME AS C.

**(E) FUNCTIONAL CRITICALITY EFFECTS:**

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**-DISPOSITION RATIONALE-**

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**(A) DESIGN:**  
DESIGNED TO WITHSTAND EXPECTED CORROSIVE ENVIRONMENTS (SALT FOG, FUNGUS, SAND AND DUST).  
MATERIALS AND PROCESSES ARE IN ACCORDANCE WITH MC999-0096. DESIGN MINIMUM FACTOR OF SAFETY IS 1.4.

**(B) TEST:**  
QUALIFICATION TESTS: THE TPDMS PLUG IS CERTIFIED BY SIMILARITY TO THE OVERINFLATION PLUG AS PART OF THE WHEEL ASSEMBLY. APPLICABLE WHEEL TESTING INCLUDES BURST AND WHEEL PRESSURE TESTS, DIFFUSION TEST AND EXPOSURE TO SALT FOG ENVIRONMENT.

THE WHEEL/TIRE ASSEMBLY IS CERTIFIED TO A BURST PRESSURE OF 1020 PSI AND SUBJECTED TO A DYNAMIC TEST SPECTRUM OF 4 TO 6 SIMULATED MISSION CYCLES INCLUDING CROSSWINDS AND TAXI TESTS.

DIFFUSION TEST: WHEEL/TIRE ASSEMBLIES ARE PRESSURIZED WITH NITROGEN GAS AND THERMALLY CYCLED FROM AMBIENT TO 100 DEG F TO MINUS 60 DEG F AND BACK TO AMBIENT. EACH CYCLE IS 18 HOURS LONG, AND 10 CYCLES ARE PERFORMED. THERE IS A ONE HOUR MINIMUM DWELL AT EACH TEMPERATURE EXTREME.

A DYNAMIC TEST TO SATISFY A 256K LANDING WEIGHT VEHICLE WAS ALSO PERFORMED - TEST CONDITIONS INCLUDED 20 KNOTS CROSSWIND, DELAYED PITCH OVER, 225 KNOTS TOUCHDOWN VELOCITY, 10 KNOTS TAILWIND AND 52,200 LBS STATIC

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LOAD PER TIRE. A MAXIMUM RADIAL LOAD OF 138K KIPS WAS APPLIED DURING THIS TEST.

ACCEPTANCE/TURNAROUND (FOR ALL WHEEL/TIRE ASSEMBLIES) CONSISTS OF;

- (1) INFLATION PRESSURE VERIFICATION.
- (2) STORAGE AT ROOM TEMPERATURE FOR 2 DAYS (TO ALLOW FOR TIRE STRETCH).
- (3) REINFLATE AND PERFORM 5 DAY COLD TEMP FOLLOWED BY 7 DAY AMBIENT TEMP LEAK TESTS.
- (4) STORAGE AT ROOM TEMP FOR 2 WEEKS.
- (5) INFLATION PRESSURE VERIFICATION (USING SAME GAUGE USED IN (1)).

**GROUND TURNAROUND TEST**

ANY TURNAROUND CHECKOUT TESTING IS ACCOMPLISHED IN ACCORDANCE WITH OMRSD. THE OMRSD DATA PROVIDED BELOW IS NO LONGER BEING KEPT UP-TO-DATE. IF THERE IS ANY DISCREPANCY BETWEEN THE GROUND TESTING DATA PROVIDED BELOW AND THE OMRSD, THE OMRSD IS THE MORE ACCURATE SOURCE OF THE DATA.

**FLIGHT TIRE PRESSURE CHECKS:**

THIS CHECK VERIFIES THE TIRE PRESSURE FOR EACH FLIGHT TIRE/WHEEL ASSEMBLY, PER THE REQUIREMENTS OF THE ML0308-0142 SPECIFICATION, IF MORE THAN 30 DAYS HAVE ELAPSED SINCE THE LAST FLIGHT TIRE PRESSURE CHECK.

**TIRE PRESSURES FOR FLIGHT:**

TIRE PRESSURES ARE VERIFIED FIVE DAYS BEFORE FINAL RETRACTION FOR FLIGHT. MLG TIRES FLIGHT PRESSURE REQUIREMENT IS 368 PSIG TO 370 PSIG.

**MLG WHEEL INSPECTION:**

WHEELS ARE INSPECTED PER THE MLG WHEEL/TIRE ASSEMBLY AND INSPECTION SPECIFICATION ML0308-0142 WHICH STATES; "... VISUALLY INSPECT ALL COMPONENTS OF THE MAIN WHEEL ASSEMBLY FOR CRACKS, NICKS, CORROSION AND OTHER DAMAGE." THE WHEEL FLANGE SURFACES THAT CONTACT THE TIRE BEAD SEAT IS ALSO INSPECTED FOR CORROSION, NICKS, SCRATCHES AND OTHER DAMAGE. REPAIRS ARE PERFORMED PER THE MANUFACTURER'S RECOMMENDATIONS.

**MLG WHEEL/TIRE CERT:**

VERIFIES MLG WHEEL/TIRE ASSEMBLY HAS BEEN BUILT UP AND TESTED PER THE VO70-510002 DRAWING, ML0308-0029 LANDING GEAR RIGGING SPECIFICATION AND ML0308-0142 MLG WHEEL/TIRE INSTALLATION AND INSPECTION SPECIFICATION. THIS INCLUDES TORQUING THE INFLATION VALVE CAP TO A VALUE OF 8 TO 10 IN-LBS.

**FREQUENCY - ALL VEHICLES AT GROUND TURNAROUND.**

THIS REQUIREMENT FOR THE OVER-INFLATION PLUG IS NO LONGER EFFECTIVE AFTER OV-102 MAJOR MOD., OV-103 FLT. 12, OV-104 FLT. 9.

**(C) INSPECTION:**

RECEIVING INSPECTION

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RECEIVING INSPECTION VERIFIES 6061-T6 ALUM., 304 CRES, 316L CRES, 200 NICKEL, ACRYLIC-BASED ADHESIVE AND PARKER O-RING (E603-7). B. F. GOODRICH RECEIVING INSPECTION CHECKS DIMENSIONS AND CERTIFICATIONS.

**CONTAMINATION CONTROL**  
CLEANLINESS AND CORROSION PROTECTION REQUIREMENTS ARE VERIFIED BY INSPECTION.

**ASSEMBLY/INSTALLATION**  
INSPECTION VERIFIES DIMENSIONS, FABRICATION AND ASSEMBLY PROCEDURES.

**CRITICAL PROCESSES**  
ANODIZATION PER MIL-A-8625A TYPE II VERIFIED BY INSPECTION.

**NONDESTRUCTIVE EVALUATION**  
CONTINUITY OF ANODIZATION VERIFIED BY B. F. GOODRICH INSPECTION.

**TESTING**  
B. F. GOODRICH AND THE PLUG SUPPLIER EACH CONDUCT BURST TESTS (EACH LOT OF PLUGS; HALF OF SAMPLES AT LOWER TEMPERATURE LIMIT AND HALF AT UPPER TEMPERATURE LIMIT) WHICH ARE VERIFIED BY INSPECTION. B. F. GOODRICH AND THE PLUG SUPPLIER EACH CONDUCT 100% PRESSURE LEAK TESTS (HALF OF PLUGS AT EACH OF THE TEMPERATURE LIMITS), VERIFIED BY INSPECTION.

**PACKAGING/HANDLING**  
HANDLING AND PACKAGING REQUIREMENTS ARE VERIFIED BY INSPECTION.

**(D) FAILURE HISTORY:**  
NONE.

**(E) OPERATIONAL USE:**  
FAILURE DETECTED ON ORBIT - AN ABORT DECISION IS REQUIRED TO SELECT A SUITABLE LANDING PROFILE/SITE.  
TIRE/WHEEL FAILURE BEFORE NLG TOUCHDOWN - CREW WILL ATTEMPT TO USE AERO RUDDER AND BRAKING ON THE OPPOSITE SIDE IN AN ATTEMPT TO MAINTAIN DIRECTIONAL CONTROL.  
TIRE/WHEEL FAILURE AFTER NLG TOUCHDOWN - CREW WILL USE NWS, AERO RUDDER AND DIFFERENTIAL BRAKING TO MAINTAIN DIRECTIONAL CONTROL.

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**- APPROVALS -**

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EDITORIALLY APPROVED : BNA : *J. Kumura 8/3/97*  
EDITORIALLY APPROVED : JSC : *D. Searcy 9-15-97*  
TECHNICAL APPROVAL : VIA APPROVAL FORM : 96-CIL-011\_02-1E